TECHNICAL NOTE TNOI34

Title: Communication with Siemens S7-300 PLCs via Ethernet

Product(s): G3, MC, and DSP

ABSTRACT

Crimson 2.0 provides advanced Ethernet communication capabilities for Red Lion Products, G3 HMI, Modular Controller and Data Station Plus. The Siemens S7-300 Ethernet driver allows users to exchange PLC data with Red Lion devices using industrial Ethernet networks.

INTRODUCTION

The following technical note presents how to set up the communication between a G3 HMI and an S7-300 PLC using Ethernet and Siemens ISO Protocol. This document can also be used as a reference to set up the Modular Controller Master and Data Station Plus SX or GT due to similar configuration.

Three major types of connections are available as described below. They will all be presented in this document. Your application should follow only one of these setups.

- Communication with S7-300 CPU with built in Ethernet port and supporting Siemens ISO protocol.
- Communication via optional Ethernet card for S7-300 series type CP343-1 supporting TSAP connections (e.g. CP343-1 Advanced IT).
- Communication via optional Ethernet card for S7-300 series type CP343-1 that does NOT support TSAP connection (e.g. CP343-1 Lean).

The Ethernet driver has been tested and validated with the following products:

- CPU315-DP/PN – P# 6ES7 315-2EG10-0AB0, v2.3
- CP343-1 – P# 6GK7 343-1EX20-0XE0, v1.1
- CP343-1 Advanced IT – P# 6GK7 343-1GX21-0XE0, v1.0
- CP343-1 Lean – P# 6GK7 343-1CX00-0XE0, v1.0

NOTE: These features only work with Crimson 2.0 build 315 or above and is only available to Windows 2000 or above users. Please update your version of Crimson 2.0 to the latest available online on www.redlion.net

SETUP 1 – S7-300 CPU WITH BUILT IN ETHERNET PORT

Setting up the PLC for CPU communication

In order to establish the communication, the PLC has to be set up first, as G3 communication settings depend on the PLC's.

Start SIMATIC Manager and follow the wizard to create a new project. In this example, we will be using a CPU315-2 PN/DP. Once created, the project browser should look similar to figure 1.

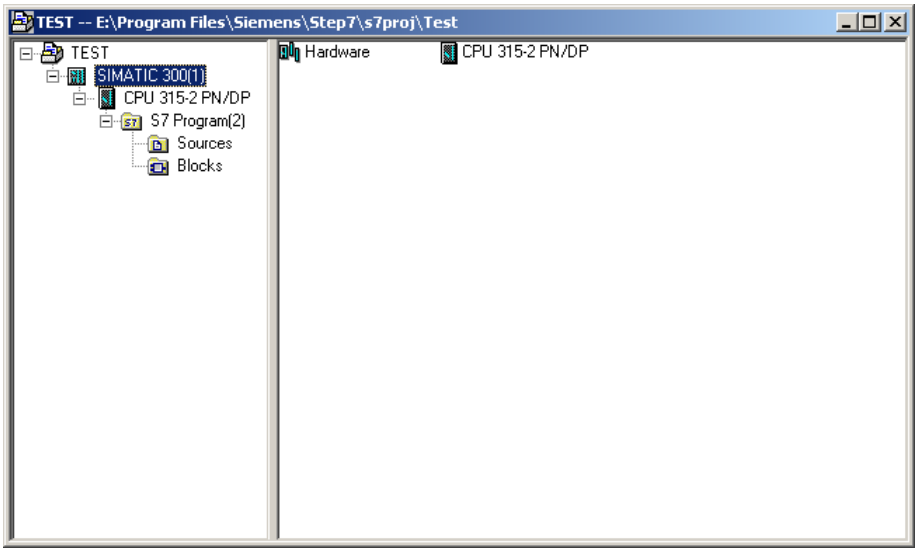

Figure 1

Select the SIMATIC 300 PLC in the tree and double click the Hardware symbol to access HW Config.

Double click the PN-IO to access the Ethernet port configuration as shown in Figure. 2. Please note the CPU rack number and slot position, here respectively 0 and 2, as it will be important to set up Crimson 2.

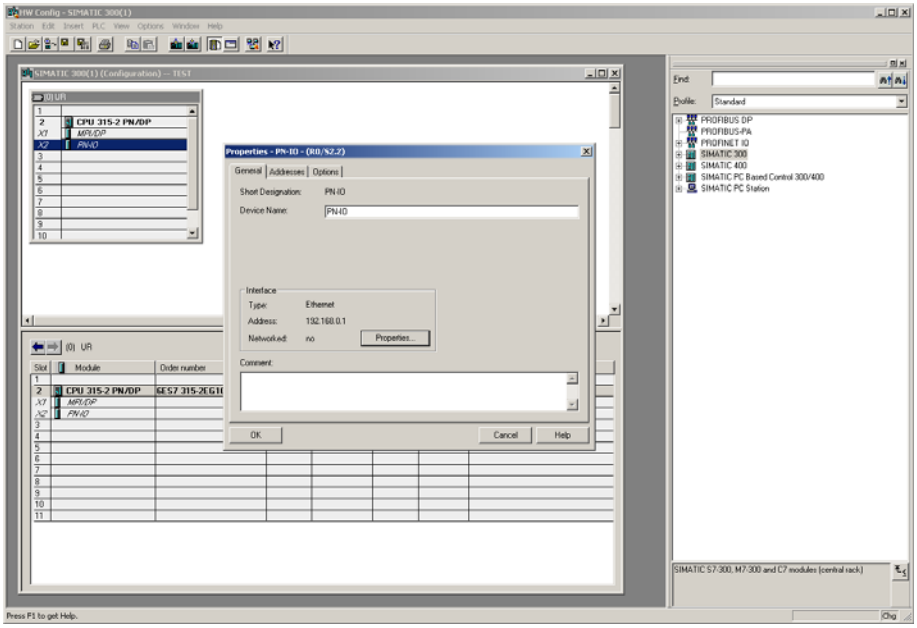

Figure 2

In the General tab, click on Properties; this opens a popup window where you can set up the Ethernet network. Do as follows (Figure 3):

1. Setup the IP address for the PLC, here 192.168.200.20.
2. Click new to create a new Ethernet network.
3. Click OK.

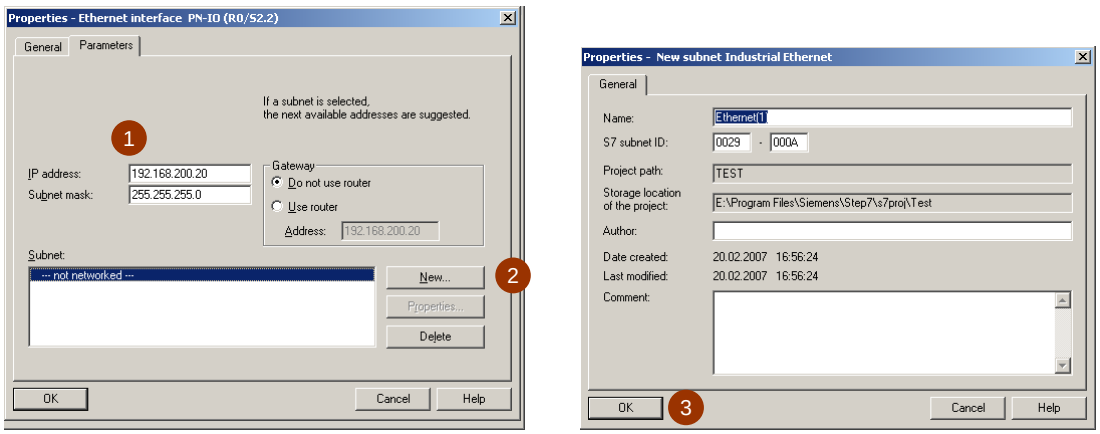

Figure 3

4. Make sure the Ethernet network just created is selected. This identifies the Network the CPU will be connected to and activate the Ethernet port (Figure 4).

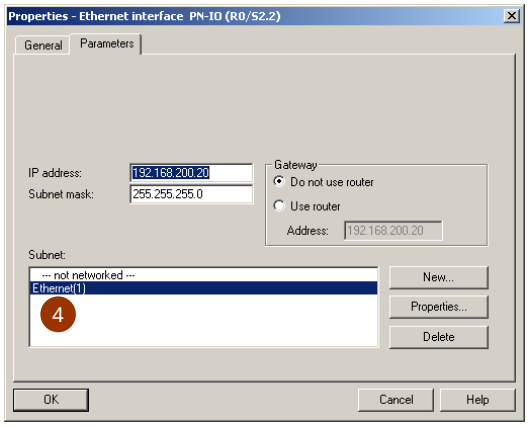

Figure 4

Then click OK to close all popup windows and return to HW Config. Save the configuration and close HW Config. The PLC configuration is done; you can now download in the PLC.

Setting up the G3 for CPU communication

Once the PLC is setup, all required information is available to configure the G3. Start Crimson 2.0 software and create a new database (via File>New). Select the device you are programming. In this example, we will be using a G306 HMI.

Enter the “Communications” module and follow the steps as shown in figure 5:

1. Select the Ethernet port.
2. Define the port mode. In this example, it will be Manual configuration.
3. Enter the G3 IP address if required. Here 192.168.200.10.

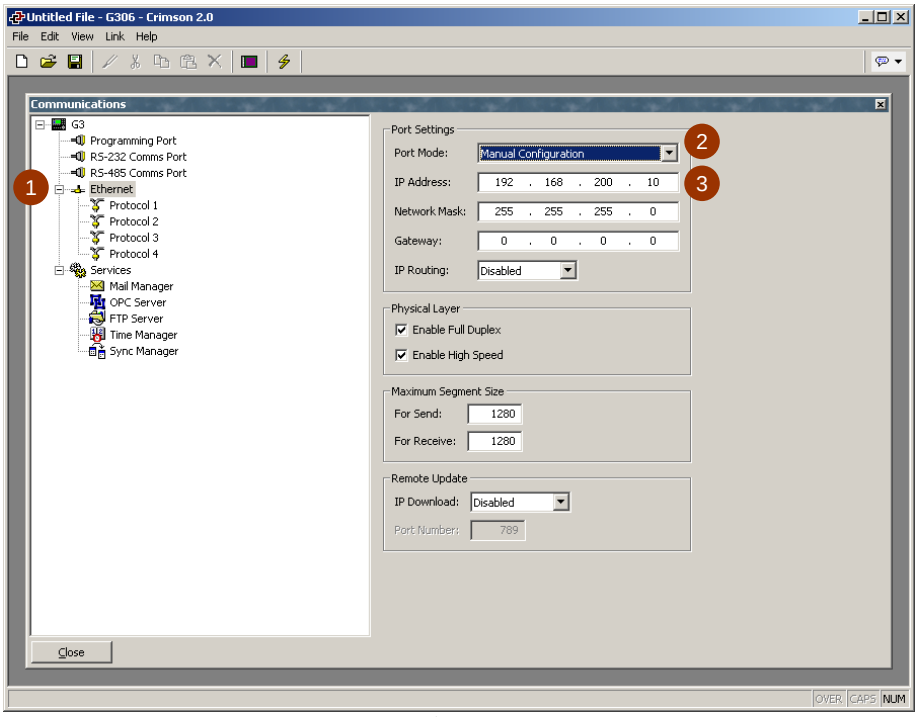

Figure 5

Once the Ethernet port is activated, the communication driver has to be defined as follows (Figure 6):

1. Select the Protocol 1 under Ethernet.
2. On the right hand pane, click Edit to select a driver.
3. In the popup window, under Manufacturer, select Siemens.
4. Then, under Driver, select S7 300 TCP/IP Master and click OK.

A device called PLC1 should then appear under the Protocol 1. This device represents the Siemens PLC and can be renamed to fit your application.

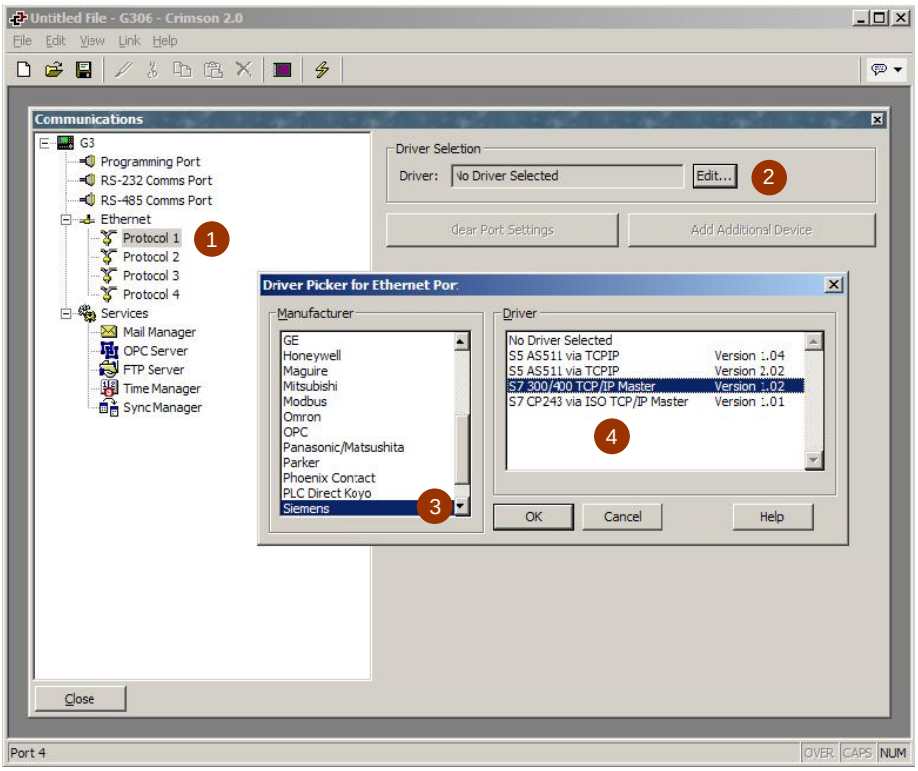

Figure 6

In this example, the device will be renamed S7300. Right-clicking the PLC and selecting “Rename” can achieve renaming.

The device settings have to be set up to fit the PLC configuration (Figure 7).

1. Select the device representing the PLC.
2. Change the IP address to the PLC IP address, in this example 192.168.200.20.
3. Select the Type as S7 300 CPU.
4. Enter the CPU rack number, in this example 0.
5. Enter the CPU slot position on the rack, in this example 2.

The communications settings are now complete. Close the “Communications” module and enter the “Data Tags” module to map variables to PLC registers as shown in Figure 8. For example, to map a Data Block, do the following steps:

1. Create an integer variable.
2. Select the variable, click on “Internal” in the Data tab and select the device (here S7 300).
3. Select the Siemens data item to exchange, here DB.
4. Choose the data type (See note on Data Type next page).
5. Select the starting element for the data item (Identical to PLC addresses) and click OK.

Once the tags are inserted on the screen, the database is now ready and can be downloaded in the G3.

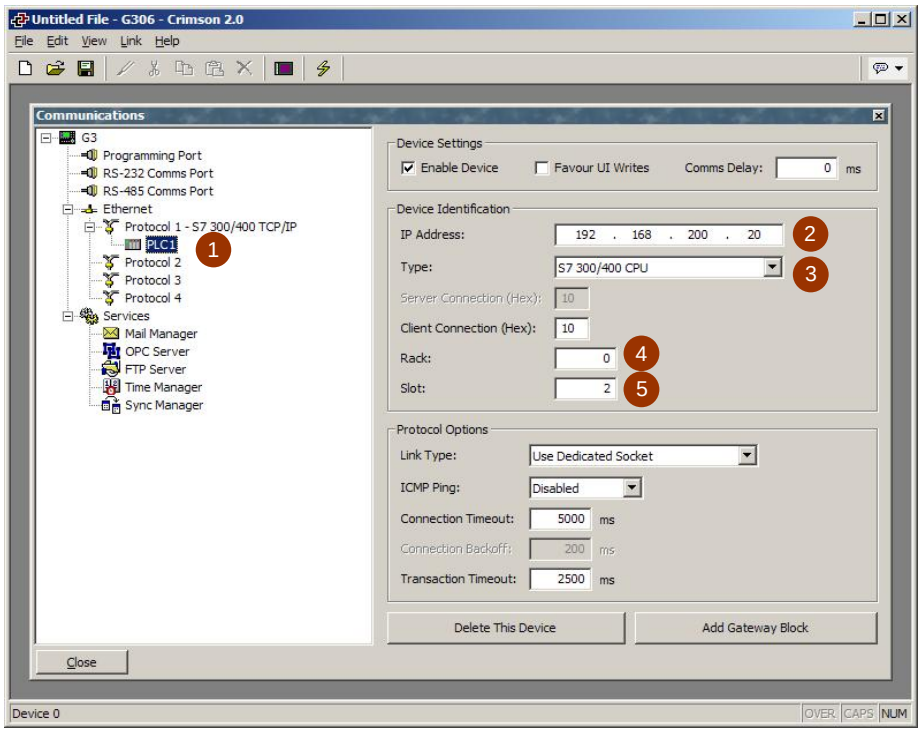

Figure 7

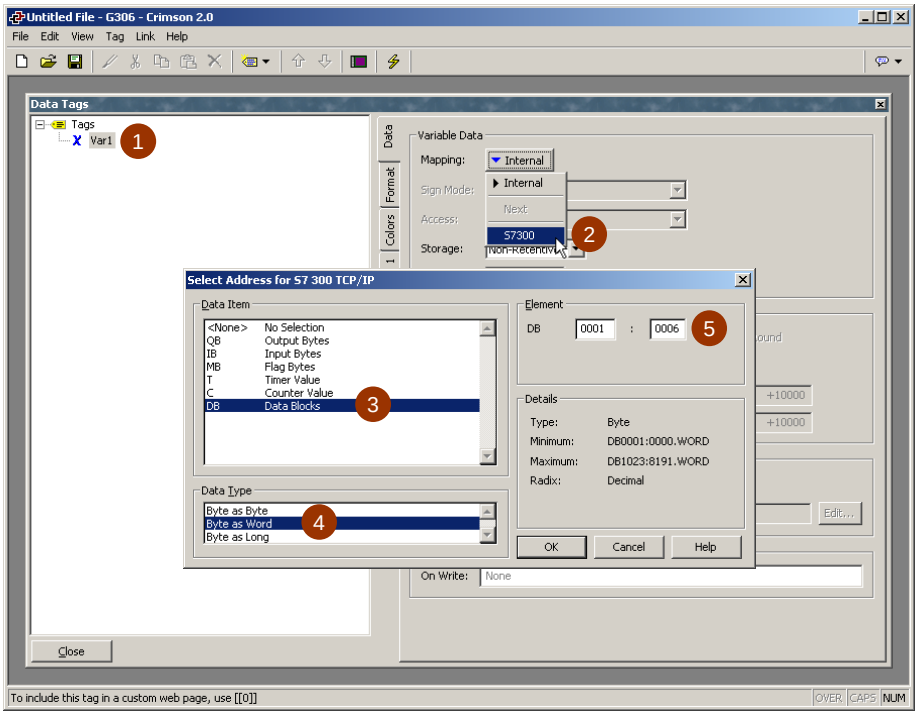

Figure 8

Note on Data Type

Byte as Byte means the variable will contain a Byte, Byte as Word an integer word and Byte as Long an integer long, the G3 will ask the PLC the number of bytes required to reconstruct the data type selected.

For example, for a Byte as Word mapped at DB001:006, the G3 will ask for DB001:006 and DB001:007 and reverse the bytes to reconstruct the word automatically. The address given in the Element should be the same as the one defined in the PLC Data Block for this example.

SETUP 2 – COMMUNICATION VIA CP343 OPTIONAL ETHERNET CARD SUPPORTING TSAP CONNECTIONS

Setting up the PLC for Cp343 communication

In order to establish the communication, the PLC has to be set up first, as G3 communication settings depend on the PLC's.

Start SIMATIC Manager and follow the wizard to create a new project. This example is using a CPU315-2DP, and a CP343-1. Once created, the project browser should look similar to figure 9.

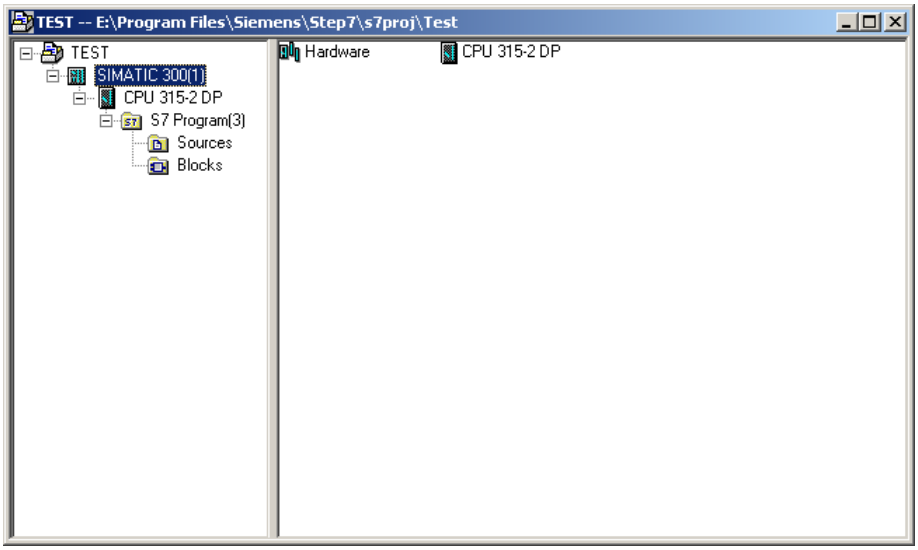

Figure 9

Select the SIMATIC 300 PLC in the tree and double click the Hardware symbol to access HW Config.

Once in HW Config, browse the object library on the right hand pane to find the optional Ethernet card CP343-1. Drag and drop the card to an available slot as shown in figure 10.

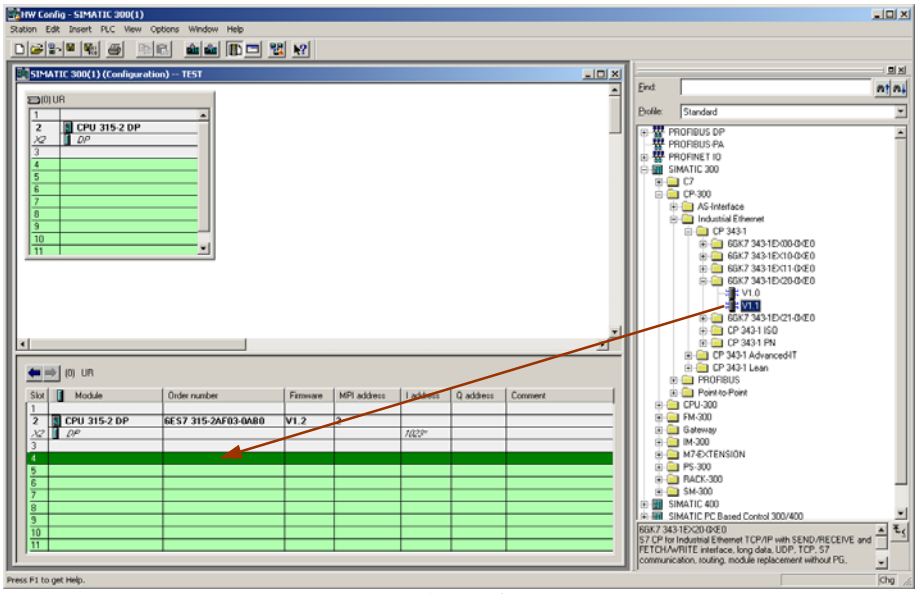

Figure 10

When you drop the object on a slot, a window will pop up for the Ethernet configuration.

Do as follows (Figure 11):

1. Setup the IP address for the PLC, here 192.168.200.20.
2. Click new to create a new Ethernet network.
3. Click OK.

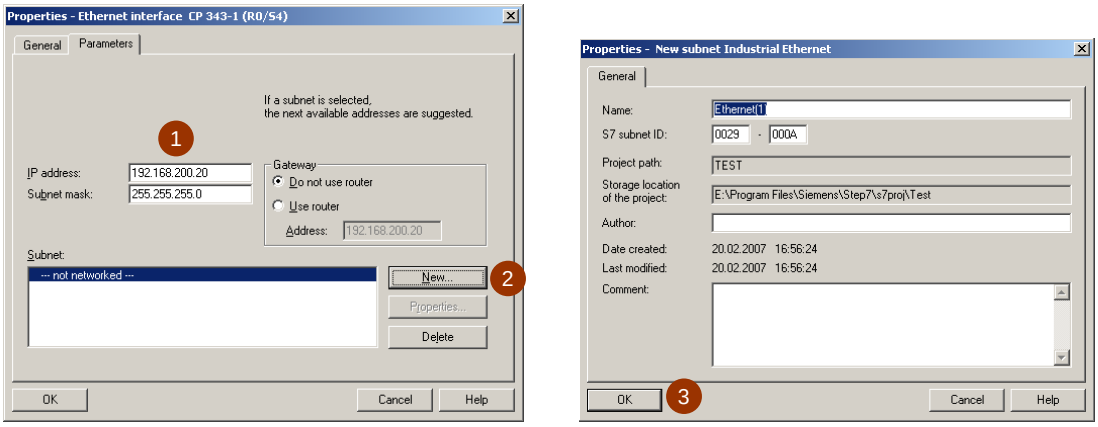

Figure 11

4. Make sure the Ethernet network just created is selected. This identifies the Network the CP343 will be connected to and activate the Ethernet port (Figure 12).

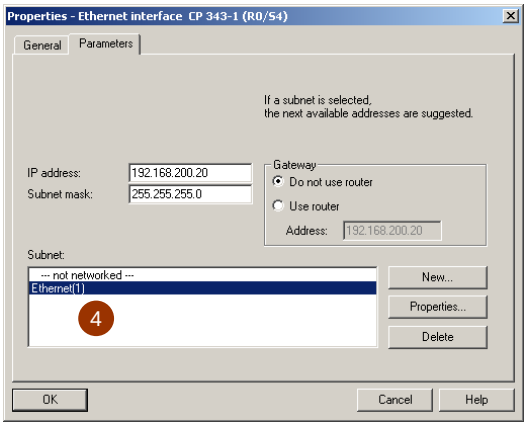

Figure 12

Then click OK to close all popup windows and return to HW Config. Save the configuration and close HW Config.

The project manager should now display the CP343-1 communication card in the tree (Figure 13).

It is now required to create a connection between the PLC and the G3. This connection is set up in Net Pro. Select the PLC CPU and double click on the “Connections” icon (Figure 13) to access NetPro configuration tool.

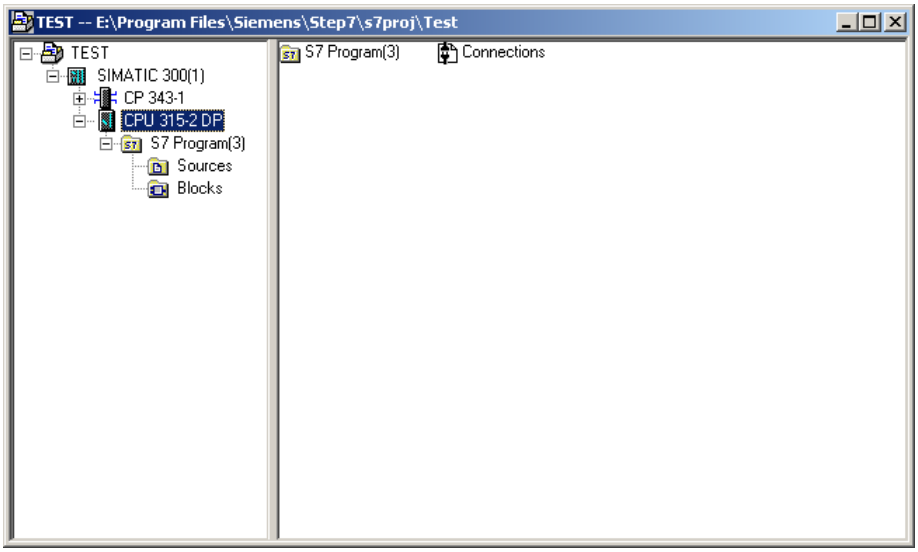

Figure 13

Once in NetPro, select the CPU and double click on the first line in the table below. This will open a window to insert a new connection (Figure 14).

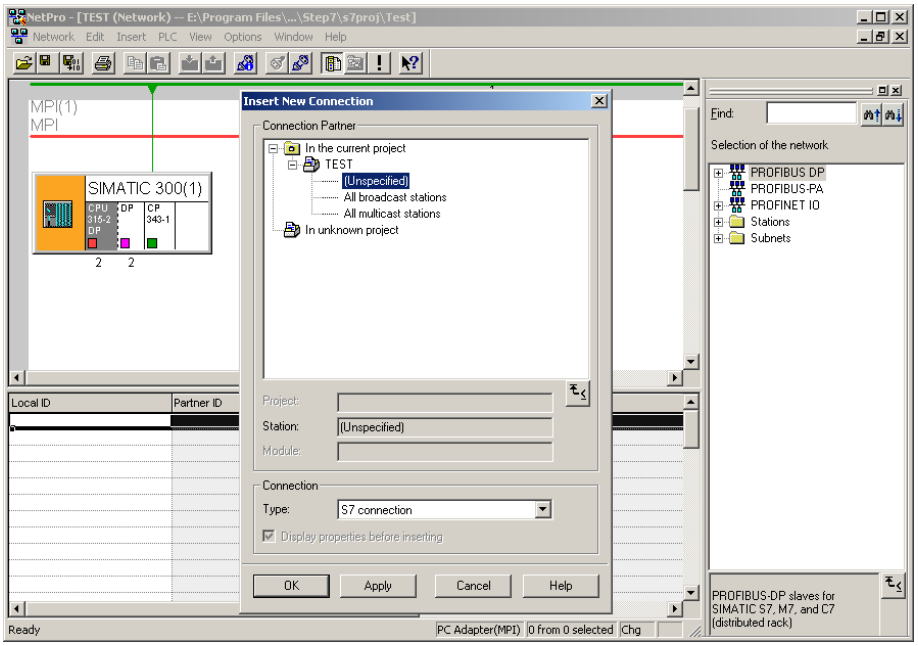

Figure 14

Make sure Unspecified is selected and the connection type is S7, then click OK.

A property window for the S7 connection pops up. Enter the following information as shown in figure 15:

1. Make sure “Establish an active connection” is NOT checked; this makes the PLC the Server.
2. Make sure the Interface selected is CP 343-1.
3. Enter the Partner name (any name works), in this example G306. The partner is the device the S7 will create a connection.
4. Enter the Partner IP address, in this example 192.168.200.10.

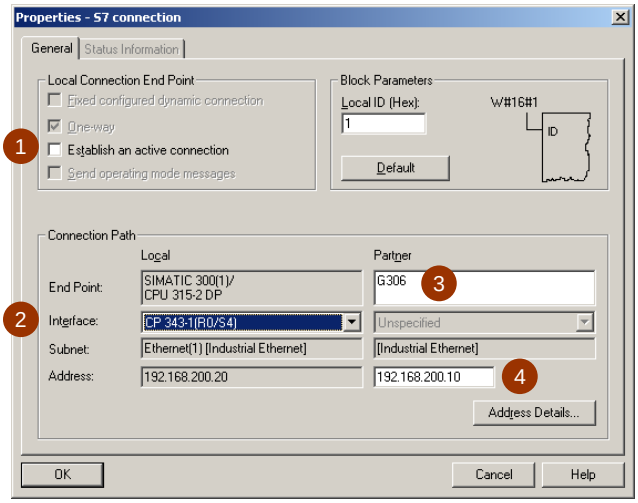

Figure 15

Then, click on Address details. This popup window is important as it contains communication information to setup the G306 in Crimson 2 (Figure 16). They are as follows:

1. PLC Connection Resource
2. PLC TSAP information. The first part of the number, before the decimal point represents the Server Connection Resource, the second part is the rack slot number where the CP343 is installed. In this example, the Connection Resource is 10 and the slot 04.
3. Partner Rack/Slot, they should stay at zero.
4. Partner Connection Resource, this number can be different from the PLC Connection Resource.

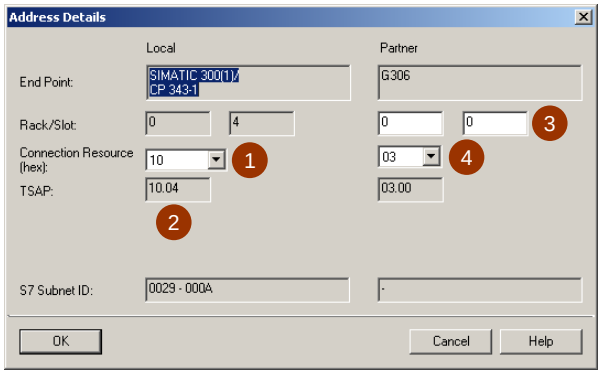

Figure 16

Click OK to close all popup windows and go back to NetPro. The table now shows the connection just created on the first line.

Save and compile in NetPro and close this window to go back to the project manager.

The PLC is now setup. Download the configuration and make sure the PLC takes the entire configuration, especially the connection settings. We recommend using the command “PLC > Compile and Download Objects…”

Setting up the G3 for CP343 communication using TSAP connections

Once the PLC is setup, all required information is available to configure the G3. Start Crimson 2.0 software and create a new database (via File>New). Select the device you are programming. In this example, we will be using a G306 HMI.

Enter the “Communications” module and follow the steps as shown in figure 17:

1. Select the Ethernet port.
2. Define the port mode. In this example, it will be manual configuration.
3. Enter the G3 IP address if required. Here 192.168.200.10.

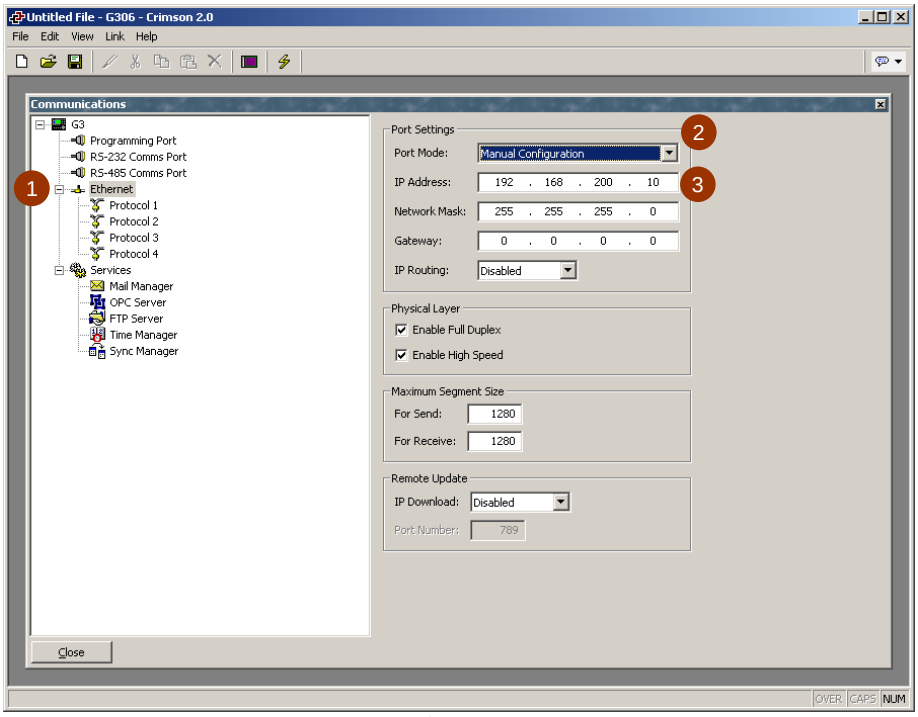

Figure 17

Once the Ethernet port is activated, the communication driver has to be defined as follows (Figure 18):

1. Select the Protocol 1 under Ethernet.
2. On the right hand pane, click Edit to select a driver.
3. In the popup window, under Manufacturer, select Siemens.
4. Then, under Driver, select “S7 300 TCP/IP Master” and click OK.

A device called PLC1 should then appear under the Protocol 1. This device represents the Siemens PLC and can be renamed to fit your application.

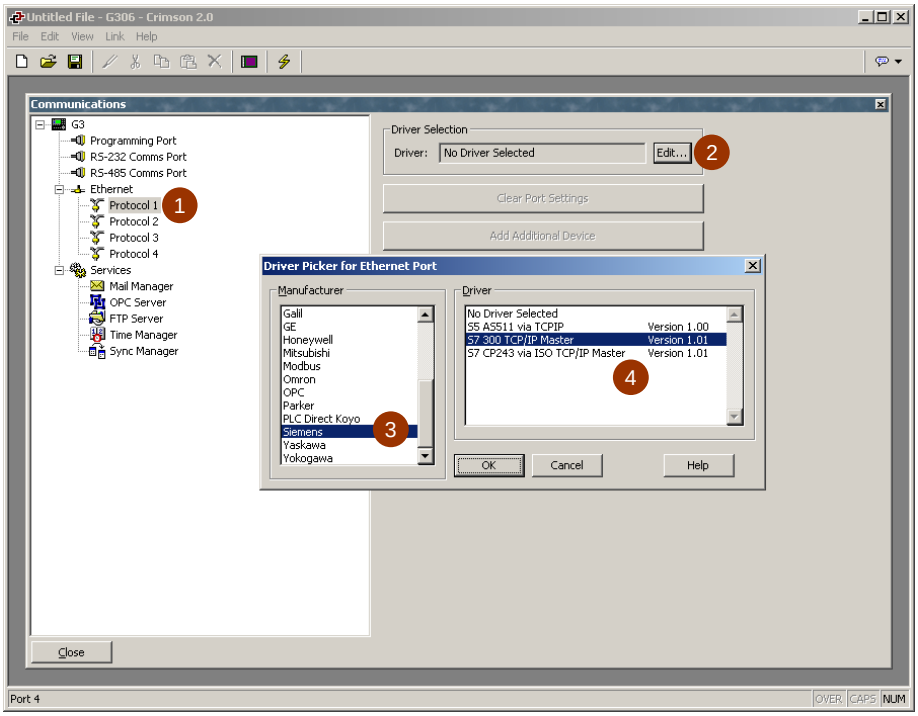

Figure 18

In this example, the device will be renamed S7300.

The device settings have to be set up to fit the PLC configuration (Figure 19).

1. Select the device representing the PLC.
2. Change the IP address to the PLC IP address, in this example 192.168.200.20.
3. Select the Type as CP 343.
4. Enter the Server connection in hexadecimal. This is the PLC Connection Resource defined in Simatic NetPro (Figure 16), in this example 10.
5. Enter the Client connection in hexadecimal. This is the G3 Connection Resource defined in Simatic NetPro (Figure 16), in this example 03.
6. Enter the CP343 Slot position in the rack (Figure 16), in this example 04.

The communications settings are now complete. Close the “Communications” module and enter the “Data Tags” module to map variables to PLC registers as shown in Figure 20. For example, to map a Data Block, do the following steps:

1. Create an integer variable.
2. Select the variable, click on “Internal” in the Data tab and select the device (here S7 300).
3. Select the Siemens data item to exchange, here DB.
4. Choose the data type (See note on Data Type next page).
5. Select the starting element for the data item (Identical to PLC addresses) and click OK.

Once the tags are inserted on the screen, the database is now ready and can be downloaded in the G3.

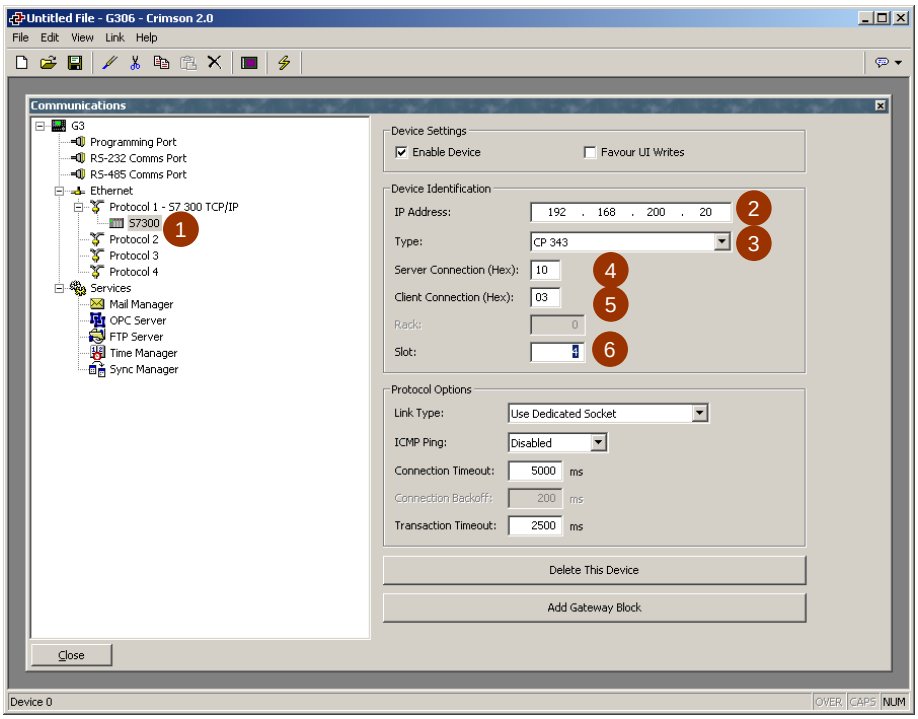

Figure 19

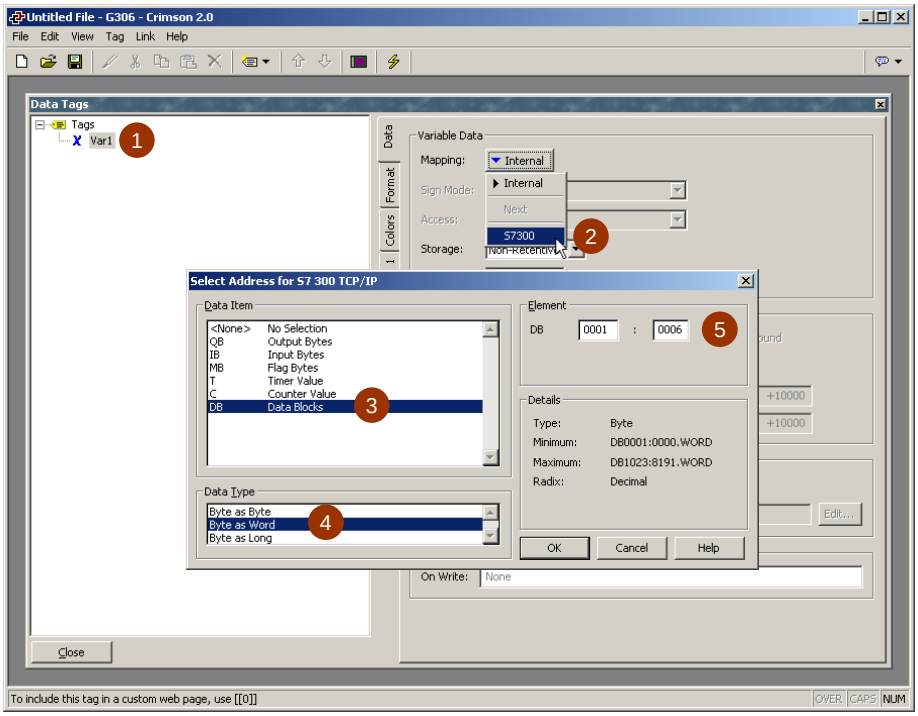

Figure 20

Note on Data Type

Byte as Byte means the variable will contain a Byte, Byte as Word an integer word and Byte as Long an integer long, the G3 will ask the PLC the number of bytes required to reconstruct the data type selected.

For example, for a Byte as Word mapped at DB001:006, the G3 will ask for DB001:006 and DB001:007 and reverse the bytes to reconstruct the word automatically. The address given in the Element should be the same as the one defined in the PLC Data Block for this example.

SETUP 3 – COMMUNICATION VIA CP343 OPTIONAL ETHERNET CARD NOT SUPPORTING TSAP CONNECTIONS (TRANSPARENT MODE)

The following setup is required if you are using a CP343-1 Lean module.

Setting up the PLC for CP343 communication

Start SIMATIC Manager and follow the wizard to create a new project. This example is using a CPU315-2DP, and a CP343-1 Lean. Once created, the project browser should look similar to figure 21.

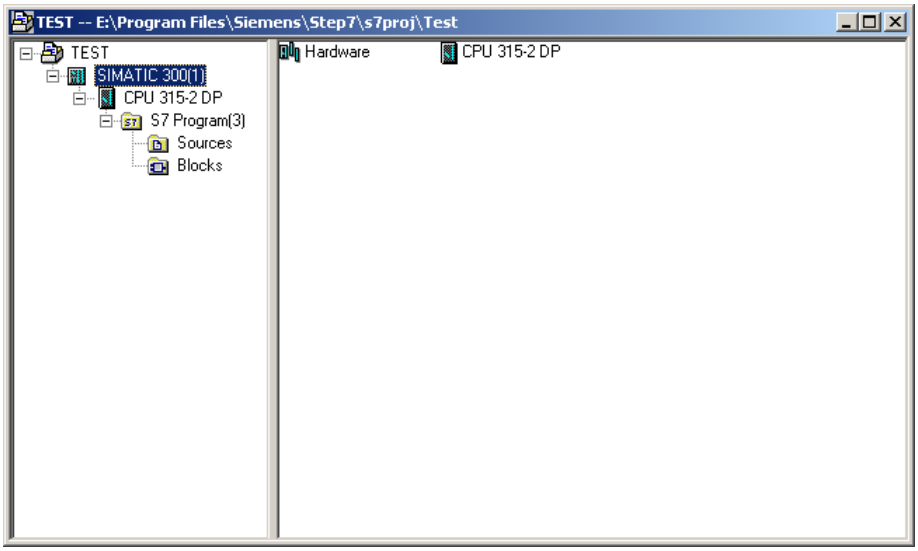

Figure 21

Select the SIMATIC 300 PLC in the tree and double click the Hardware symbol to access HW Config.

Once in HW Config, browse the object library on the right hand pane to find the optional Ethernet card CP343-1 Lean. Drag and drop the card to an available slot as shown in figure 22.

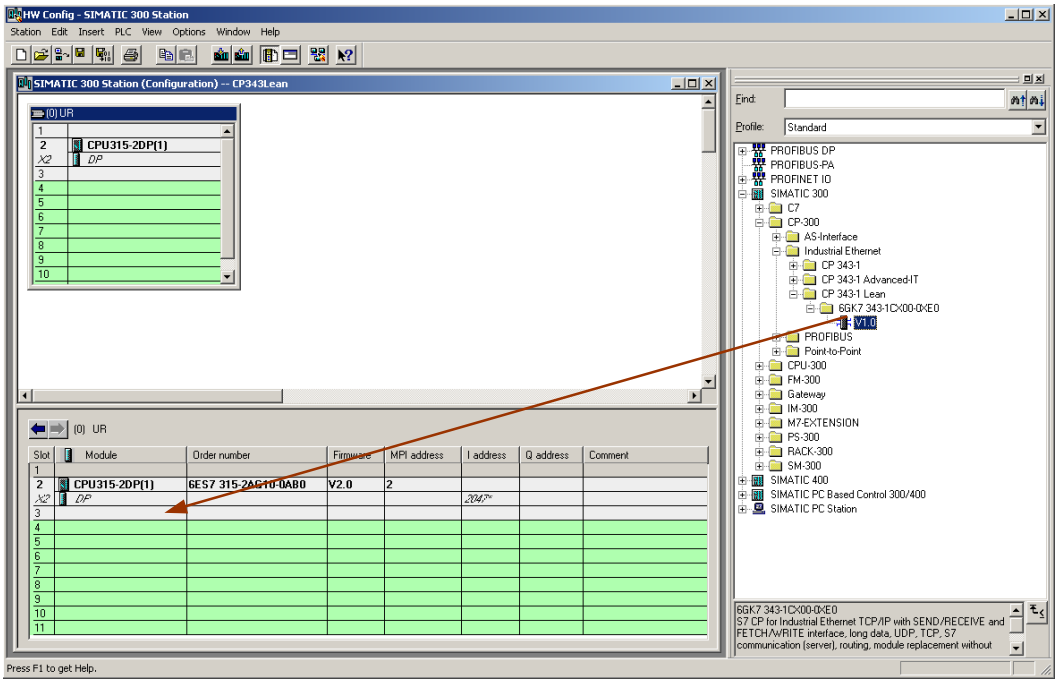

Figure 22

When you drop the object on a slot, a window will pop up for the Ethernet configuration.

Do as follows (Figure 23):

1. Setup the IP address for the PLC, here 192.168.200.20.
2. Click new to create a new Ethernet network.
3. Click OK.

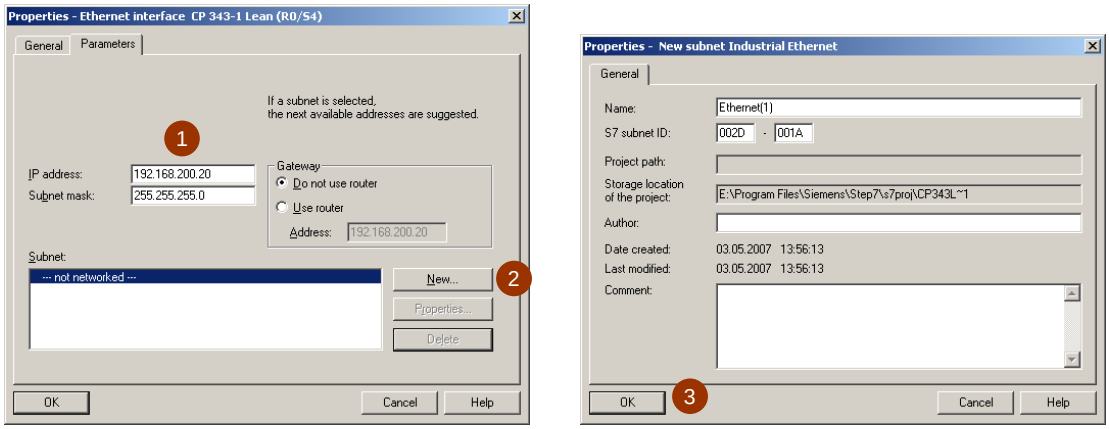

Figure 23

4. Make sure the Ethernet network just created is selected. This identifies the Network the CP343 will be connected to and activate the Ethernet port (Figure 24).

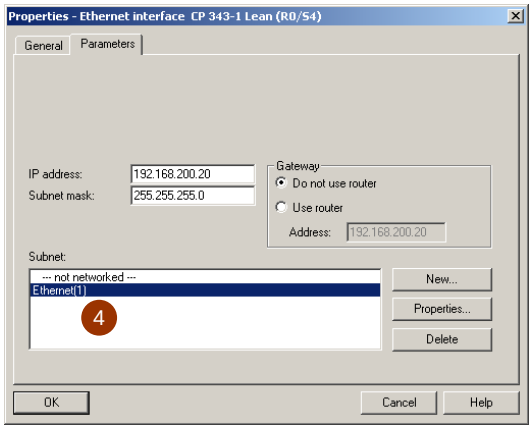

Figure 24

Then click OK to close all popup windows and return to HW Config. Save the configuration and close HW Config.

The PLC is now setup. Download the configuration and make sure the PLC takes the entire configuration.

Setting up the G3 for CP343 communication NOT supporting TSAP connections

Once the PLC is setup, all required information is available to configure the G3. Start Crimson 2.0 software and create a new database (via File>New). Select the device you are programming. In this example, we will be using a G306 HMI.

Enter the “Communications” module and follow the steps as shown in figure 25:

1. Select the Ethernet port.
2. Define the port mode. In this example, it will be manual configuration.
3. Enter the G3 IP address if required. Here 192.168.200.10.

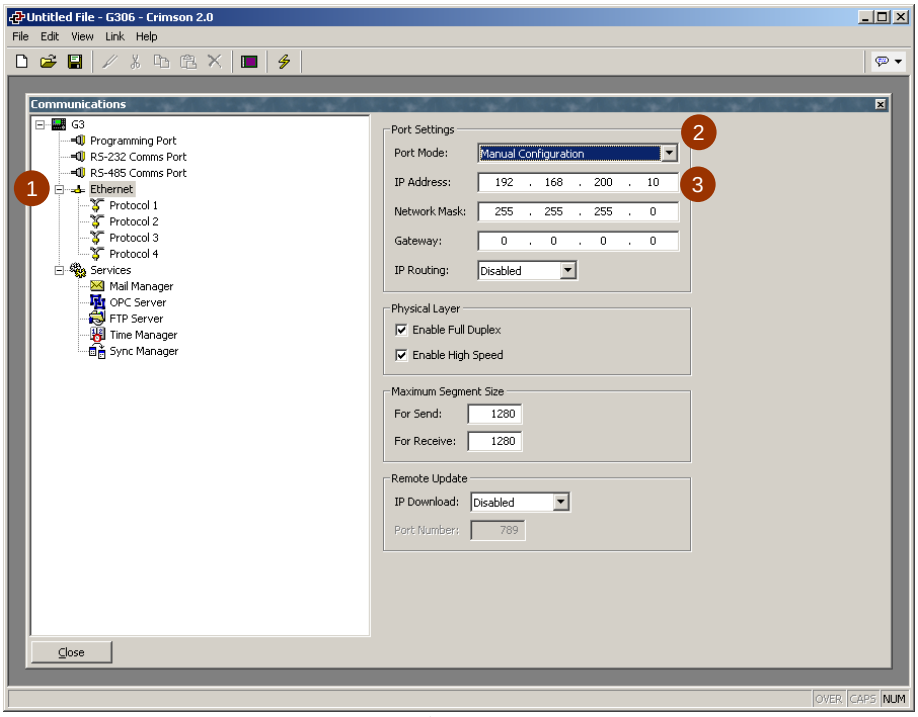

Figure 25

Once the Ethernet port is activated, the communication driver has to be defined as follows (Figure 26):

1. Select the Protocol 1 under Ethernet.
2. On the right hand pane, click Edit to select a driver.
3. In the popup window, under Manufacturer, select Siemens.
4. Then, under Driver, select “S7 300 TCP/IP Master” and click OK.

A device called PLC1 should then appear under the Protocol 1. This device represents the Siemens PLC and can be renamed to fit your application.

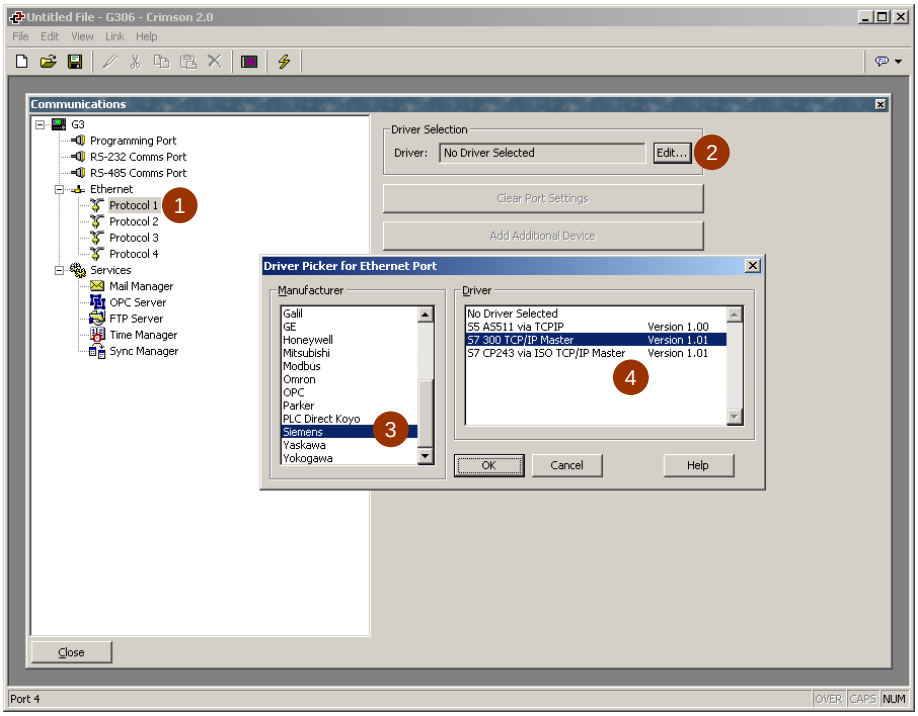

Figure 26

In this example, the device will be renamed S7300. Right-clicking the PLC and selecting “Rename” can achieve renaming.

The device settings have to be set up to fit the PLC configuration (Figure 27).

1. Select the device representing the PLC.
2. Change the IP address to the CP 343 Lean IP address, in this example 192.168.200.20.
3. Select the Type as S7 300 CPU. The driver should behave as if it communicates with a CPU directly since the CP 343 Lean is transparent.
4. Enter the CPU rack number (NOT the CP343), in this example 0.
5. Enter the CPU slot position on the rack (NOT CP343), in this example 2.

The communications settings are now complete. Close the “Communications” module and enter the “Data Tags” module to map variables to PLC registers as shown in Figure 28. For example, to map a Data Block, do the following steps:

1. Create an integer variable.
2. Select the variable, click on “Internal” in the Data tab and select the device (here S7 300).
3. Select the Siemens data item to exchange, here DB.
4. Choose the data type (See note on Data Type next page).
5. Select the starting element for the data item (Identical to PLC addresses) and click OK.

Once the tags are inserted on the screen, the database is now ready and can be downloaded in the G3.

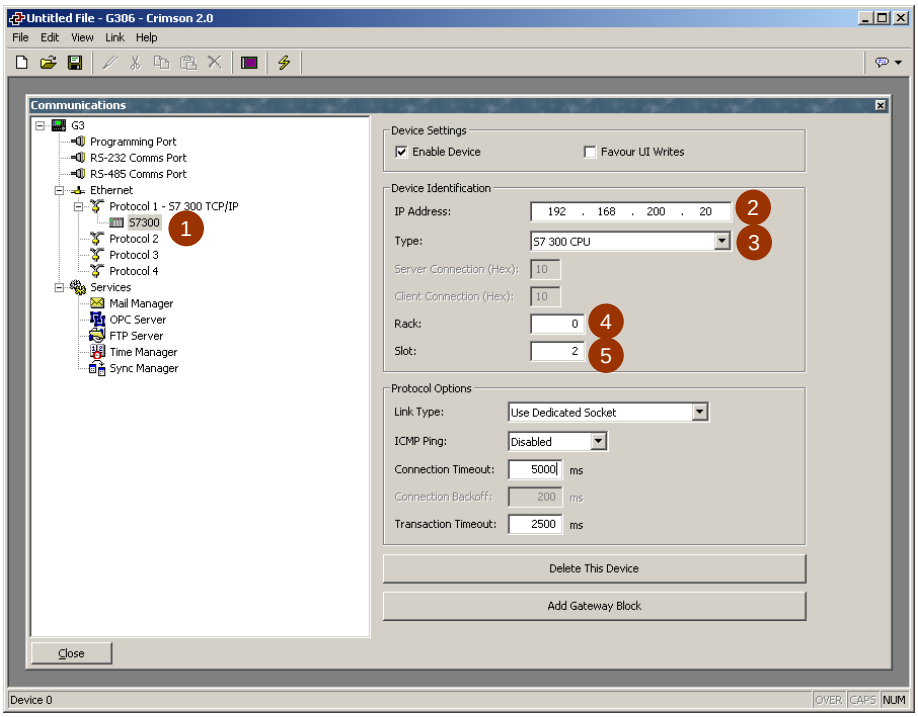

Figure 27

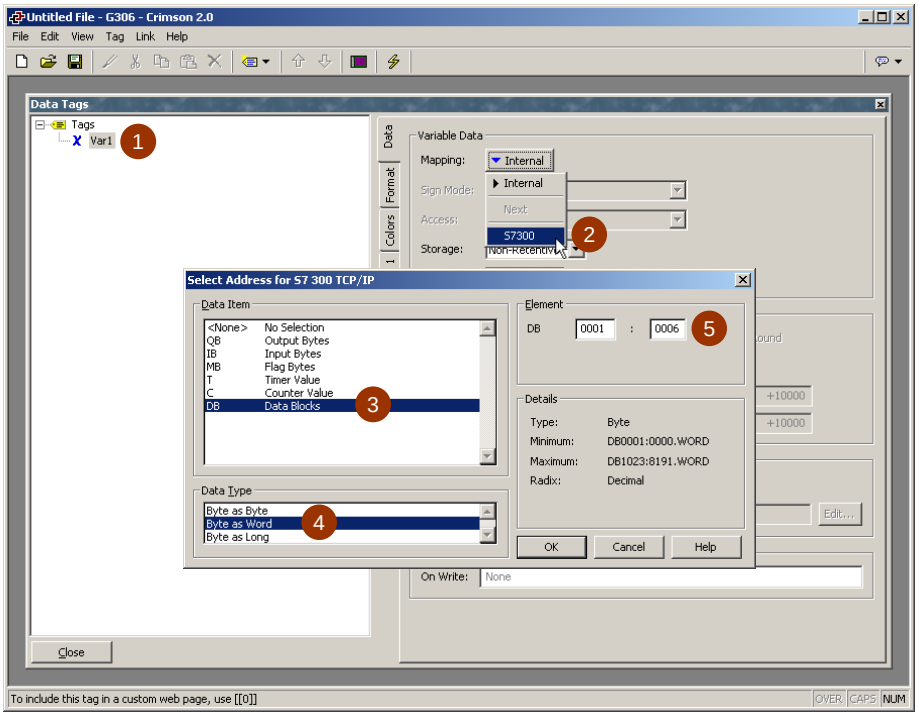

Figure 28

Note on Data Type

Byte as Byte means the variable will contain a Byte, Byte as Word an integer word and Byte as Long an integer long, the G3 will ask the PLC the number of bytes required to reconstruct the data type selected.

For example, for a Byte as Word mapped at DB001:006, the G3 will ask for DB001:006 and DB001:007 and reverse the bytes to reconstruct the word automatically. The address given in the Element should be the same as the one defined in the PLC Data Block for this example.